BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Subsidiary Diploma in Applied Science Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Biomedical Science
Unit number and title	**Unit 21: Applications of Organic Chemistry**
Learning aim(s)	**B:** Understand the properties and reactions of aromatic compounds
Assignment title	**Aromatic compounds**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a laboratory technician working in an analytical laboratory and in this role you learnt how aromatic compounds have played an important role in the synthesis of many useful compounds. A number of them have also been used as solvents in many reactions. Benzene and its derivatives are used to lubricants, dyes, drugs and pesticides. Benzene and toluene (methyl benzene) are used as solvents in many reactions to produce new compounds. Scientists also need to aware of their health risks when exposed to certain aromatic compounds. Because of this your department regularly receives visits from schools, and your supervisor has allocated you the task of testing out an assessment that will be used by the 'BTEC students' undertaking work experience in your laboratory.

Task	You will need to **plan** the multi-step synthesis of aromatic organic molecules**, analyse** mono-substituent effects on the electrophilic substitution mechanism of the benzene ring**, explain** the reactions of benzene and mono-substituted aromatic compound and **discuss** the structure of the delocalised benzene ring. Your final portfolio will comprise of the following 3 sections: Section 1 – The structure of benzene • **Discuss** the structure of benzene using diagrams and models. Provide information such as bond length, reactivity, enthalpy data as evidence for the delocalisation of electrons in a ring structure rather than a single-double bond structure. Section 2 – The reactions of benzene and typical monosubstituted aromatic compounds

- **Explain** the following reactions of benzene and typical monosubstituted aromatic compounds:
    - reaction of benzene sulfonic acid or benzenediazonium salt to form phenol
    - weak acidity of phenol, reaction with strong bases but not weak bases
    - bromination of phenol
    - condensation reaction of phenol with carboxylic acids
    - reduction of nitrobenzene to phenylamine with concentrated hydrochloric acid and tin
    - formation of benzenediazonium salt from phenylamine using sodium nitrite and hydrochloric acid below $5^{o}C$
    - formation of azo dye by coupling benzenediazonium ion with phenol and other activated benzene rings
    - nitration, chlorination and methylation of monosubstituted aromatic rings ($–CH_3$, –OH, $-NH_2$ $–NO_2$, –Cl)

give correct names, formulae, balanced equations, reactions and any products of industrial and biological importance.

- **Construct** electrophilic substitution mechanisms (nitration, chlorination and methylation) and **analyse** the effects of the mono-substituents on the benzene ring for:
    - Benzene

  PLUS AT LEAST THREE OF THE FOLLOWING mono-substituted benzene rings:
    - Methylbenzene
    - Phenol
    - Analine
    - Nitrobenzene
    - Chlorobenzene

  Account for increased or reduced activity of the benzene ring and predict positions of further substitutions on the ring. Sourced images of mechanisms are **not** acceptable evidence.

Section 3 - Synthesis routes

- **Plan** synthesis routes or maps involving at least two or more steps for each route for the following:
    - Starting material: methylphenylketone, product: benzoic acid
    - Starting material: benzene: product: phenylethanoate

	o Starting material: benzene, product: phenylamine The routes must include names, formulae, balanced equations, reaction conditions and indication of any isomeric compounds formed.
Checklist of evidence required	A research portfolio that includes: • Evidence for the structure of the delocalised benzene ring • An explanation of the reactions of benzene and mono-substituted aromatic compounds • An analysis of the effects of different mono-substituents on the electrophilic substitution mechanism of the benzene ring • 3 different examples of plans of multi-step synthesis of aromatic organic molecules.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria, you must show that you are able to:
B.D2	Plan the multi-step synthesis of aromatic organic compounds
B.M4	Analyse the effects of different mono-substituents on the electrophilic substitution mechanism of the benzene ring
B.P6	Explain the reactions of benzene and mono-substituted aromatic compounds
B.P5	Discuss the structure of benzene using sigma and pi bonding, providing evidence for delocalisation in the ring
Sources of information to support you with this Assignment	All sources of information suggested are UK based. Centres are free to amend these sources to those available in the Country of delivery where more appropriate. www.edu.rsc.org - aromatic chemistry starters; follow a synthetic route www.STEM.org.uk - organic reaction mechanisms www.chemhume.co.uk – aromatic chemistry www.tes.com – organic synthetic pathways www.chemguide.co.uk – introducing arenes Within the copyright laws learners could search YouTube for:–aromatic/benzene compounds
Notes to the Assessor	Practical work may be undertaken when teaching learners the unit content in preparation for this assignment, but is not required to complete the

and technician	assignment itself. Before doing any practical activity, you should always carry out your own risk assessment and refer to the necessary regulations. In particular, any local rules issued by your employer must be obeyed, regardless of what is suggested here. Centre should use Health and Safety information provided by a reputable source. In the UK such an example organization is CLEAPSS http://science.cleapss.org.uk/